Connected Learning With Simulations In An Integrated Learning Environment Supporting a Massive Open Online Course

Stricker, Arenas, Scribner, Calongne, Truman, & Cook

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Andrew G. Stricker, Ph.D. The Air University andrew.stricker@maxwell.af.mil	Fil J. Arenas, Ed.D. The Air University filomeno.arenas@us.af.mil	Toni Scribner The Air University toni.scribner@maxwell.af.mil
Cynthia M. Calongne, D.CS. Colorado Technical University cynthia.calongne@coloradotech.edu	Barbara Truman University of Central Florida barbara.truman@gmail.com	John A. (Tony) Cook, Ed.D. Auburn University cookja1@auburn.edu

Abstract

This paper outlines a summer experiment in the collaborative design and use of Single and Multi-Player Education Role Playing Game (SPERPGs and MPERPGs) simulations for connected learning in an Integrated Learning Environment (ILE) supporting a Massive Open Online Course (MOOC). The authors outline several ILE capabilities considered important for supporting connected learning with simulations to improve engagement and interactivity in a MOOC. ILE capabilities include an Internet learning management system (LMS), mobile apps, a 3D-world campus, and IP video-conferencing. The authors also describe the design-build prototyping by educators of four learning simulations to demonstrate the art-of-the-possible for improving engagement and interactivity in a MOOC.

Introduction

An Integrated Learning Environment (ILE) refers to a pedagogical design supporting the integration of instruction, learning, and technology for collaborative and connected environments. A key feature of emerging ILE design is the importance placed on using new media and simulation technologies for supporting the means to learn regardless of location (Haycock & Kemp, 2008). New media refers to on-demand access to content anytime, anywhere, on any digital device, as well as interactive user feedback, creative participation and community formation around the media content. Also, there is deliberate instructional systems design (ISD) focus placed on the integration of theoretical and practical knowledge through the means to interleave or blend school and authentic workplace settings via computerized activities (e.g., involving real-life scenario simulations and "what-if" model-based problem solving, reasoning tools) across a variety of instructional delivery modalities for supporting how people learn in the 21st century (Aldrich, 2009; Bransford, Brown & Cocking, 1999).

Integrated Learning Environment Architecture

The authors facilitated the voluntary engagement of several educators from across industry, higher education, and the government to help in the design, integration, and use of SPERPG and MPERPG simulations to improve engagement and interactivity in an ILE supporting a MOOC. The architecture of the ILE was designed to offer support for distributive connections and data flow among the set of system components involving a learning management system (LMS), a mobile app, a 3D world campus, and an IP video-conferencing tool (see Figure 1).

Web service data pulls and pushes linked the mobile app to the LMS-based assignment and reporting of activity with the 3D world SPERPG and MPERPG simulations among server-side MySQL databases providing for the storage, exchange and reporting of information across the ILE system components.

Figure 1. Components of Integrated Learning Environment (ILE) architecture.

Learning Management System

A Moodle LMS was used to provide a community focal point for learning management, communication, and flow of instructional resources supporting the MOOC and usage of SPERPG and MPERPG simulations across the system components employed by the ILE. The SLOODLE component, for supporting connections between a 3D world and Moodle, was also integrated with the LMS. Ten session topics were used to engage 33 volunteer educators who signed up to help prototype the SPERPG and MPERPG simulations in the ILE supported MOOC:

- Topic 1: Introduction and Overview of ILE
- Topic 2: Learning Design for Instructional Overlays
- Topic 3: Instructional Systems Design Frameworks
- Topic 4: Assessment Rubrics and Analytics
- Topic 5: Self-Paced and Collaborative Learning Models
- Topic 6: Intelligent Tutoring and AI Bot Design
- Topic 7: Mobile App Usage
- Topic 8: Enterprise Architectural Components
- Topic 9: Future Directions
- Topic 10: Wrap-up and Lessons Learned

Sessions were scheduled for consecutive weekly meetings on Monday evenings from 7-9pm central. Sessions were designed to support asynchronous and synchronous engagement of participants in the topics and use of the SPERPG and MPERPG simulations (see Figure 2). Session topics were organized in the LMS and structured for offering electronic readings, a forum discussion, in-world activities, and knowledge checks.

Figure 2. Session flow supporting topics and SPERPG / MPERPG simulations.

Mobile Apps

Web services were implemented in the LMS to support versions of the Moodle Mobile and Loire Internet Radio Station apps (available for mobile devices) used to connect with the LMS and access to instructional resources, communication, and education broadcasting among participants.

IP Video-Conferencing

The AnyMeeting IP video-conferencing tool was integrated with the LMS to support synchronous discussions among participants outside of the 3D world campus. AnyMeeting also supported automated messaging for reminding participants of upcoming sessions and polling those planning to participant.

3D World Campus

An Open Simulator mega-region was used for the 3D world campus (See Figure 3).

Figure 3. 3D world campus hosting SPERPG and MPERPG simulations.

Each session topic provided in the LMS also had representation in the 3D world campus in the form of breakout areas dedicated to the topic and in-world discussions, design studio and prototyping areas, and learning activities. Some of the in-world learning activities included the use of either a SPERPG or MPERG simulation.

Overall, the goal for embedding the SPERPG and MPERPG simulations within a 3D world campus is to support not only the flow of instructional sessions but also help the learner assume an identity for establishing presence in a virtual world providing spatial, temporal, and material conditions for immersion and interactivity for learning with simulations (Calongne, 2008; Annetta, Folta, & Klesath, 2010). A 3D learning experience (3DLE) involves a highly immersive virtual environment whereby learners can interact in real-time with each other with the option to be facilitated by an instructor to accomplish a specific activity.

Effective use of 3DLEs provides for peer-to-peer or group learning through a series of activities designed to synthesize conceptual learning through immersive interactivity (Kapp & O'Driscoll, 2010). Also, with the use of imagery, dynamic models, and sound effects, an immersive 3D world can be designed for supporting flow-like engagement when learning with simulations (Arenas & Stricker, 2013).

The 3D world used for the ILE, described in this paper, took the form of a campus named the Loire Learning Campus. The Loire Learning Campus was used to place the SPERPG and MPERPG simulations in the context of familiar learning settings, services and scholarly domains associated with a physical campus. The use of a 3D world campus also helped with supporting meaningful context for participants to review concepts presented in the LMS, expand on them, assimilate with existing knowledge and apply to new situations via the use of the SPERPG and MPERPG simulations.

Instructional Systems Design for SPERPG and MPERPG Simulations

The PADDIE+M ISD model was used to guide the process in planning, analyzing, designing, developing, implementing, and evaluating the SPERPG and MPERPG simulations (see Figure 4).

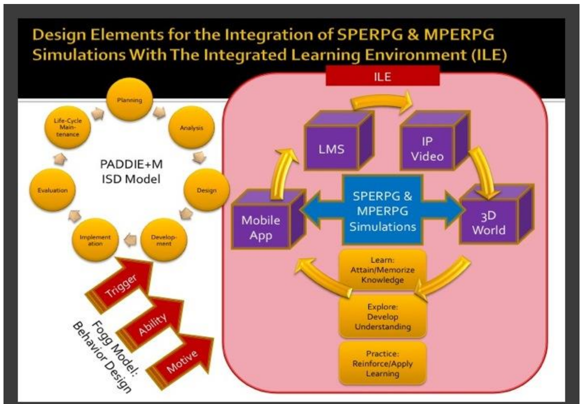

Figure 4. High-level design of integration of simulations with ILE.

The structure of the SPERPG and MPERPG simulations also placed emphasis on behavior design principles to better support the clarity of triggers used to immediately engage participants, making sure the actions required were as simple as possible in line with ability, and offering game-like motivations for completing tasks (Fogg, 2009).

The learning flow of each SPERPG and MPERPG simulation was designed to support conceptual elaboration sequenced across cascaded tasks supporting learning, exploring, and practicing new skills (See Figure 5).

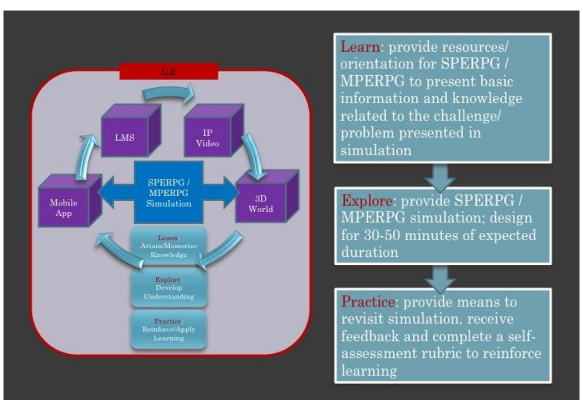

Figure 5. Learning flow of SPERPG and MPERPG simulations.

The underlying instructional framework, employed in the design of the SPERPG and MPERPG simulations, was crafted using collaborative design thinking by the participants to apply social-constructivist viewpoints regarding the value of situated, experiential, and inquiry-based learning (Reigeluth, et. al., 1999; Lave & Wenger, 1991; Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1989; Schank & Jona, 1991; Collins & Stevens, 1983).

A *social-constructivist* learning approach places emphasis on engagement in authentic and meaningful context for knowledge construction and application. The foundations of the social-constructivist learning approach originates from the cognitive approach to psychology of learning (Jonassen, Peck, & Wilson, 1999), these theories were derived from Piaget (1952), Dewey (1966), Papert (1980), and Bruner (1985).

By means of design thinking and design-build prototyping, making use of social-constructivist learning research, there are innovative possibilities for supporting authentic and meaningful learning using new media and simulations. Simulations can be designed for use in a 3D environment whereby learners are engaged in a meaningful context for new concepts and to find their own solutions to problems based on their prior knowledge and experiences (Cheney & Sanders, 2011).

The SPERPG and MPERPG simulations were designed to offer challenges in a meaningful context for acquiring new concepts, expand on them, and practice the application of new constructed knowledge. Altogether, the simulations were designed to promote cognitive strategies for problem identification, analyzing options, and self-regulation of performance for successful outcomes (Putnam, 1991; Schon, 1987).

Single and Multi-Player Education Role Playing (SPERPG and MPERPG) Game Simulations

Collaborative design thinking for design-build prototyping was used by the participants to help construct, integrate each with the ILE, test, and evaluate the four SPERPG and MPERG simulations. Collaborative design thinking for design-build prototyping involves methods and tools supporting the use of design studios to explore, identify, and create innovative solutions (Stricker, et. al., 2011). Each simulation is briefly described below.

PADDIE+M ISD SPERPG Simulation. This simulation was designed to help participants understand the application of the PADDIE+M ISD model (NAVEDTRA, 2010) in the design of SPERPG and MPERPG simulations (see Figure 6).

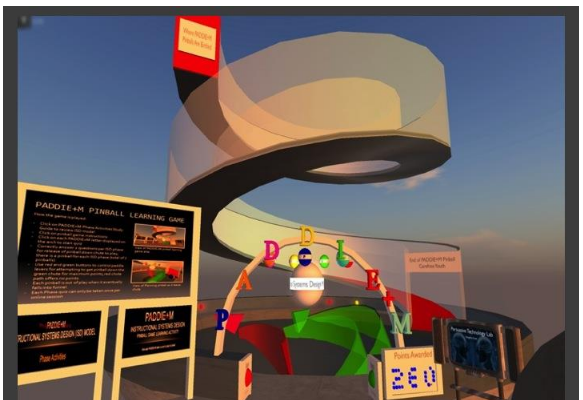

Figure 6. PADDIE+M ISD SPERPG simulation.

Participants start the PADDIE+M ISD SPERPG by clicking on the study kiosk in-world to review the ISD model phases. After studying the ISD phases, the player then clicks on each PADDIE+M letter displayed on the arch to answer a few questions. If correct answers are received a pinball is released down the spiral chute for play. There is a pinball for each of the ISD phases. When a pinball reaches the funnel then the player flips paddle levers for attempting to get the pinball down the green chute for maximum points. Each pinball is out of play when it eventually falls into the inner hole of the funnel. Pinball game sounds, award points, and text from each pinball offer game-like triggers and motivation for learning about each of the PADDIE+M ISD phases.

Player data is collected in the form of selections made with devices, responses to questions, action taken, and points earned in the SPEPRG. Data is used by the SPERPG for feedback to the player.

OLD CARTS In Clinical Medicine SPERPG. This simulation highlights the use of artificial intelligent (AI) avatar bots in an SPERPG (see Figure 7).

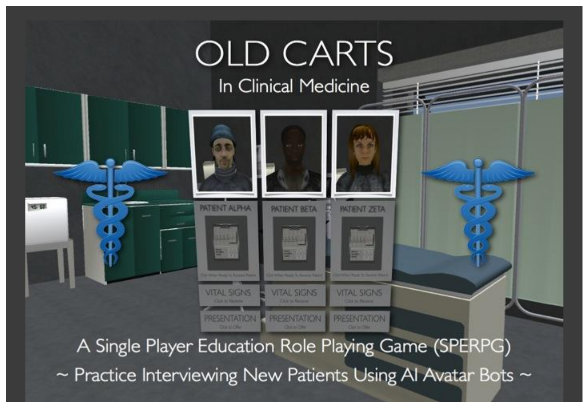

Figure 7. OLD CARTS SPERPG simulation.

The learning purpose of the OLD CARTS In Clinical Medicine SPERPG simulation is to offer instruction and assistance with the development of understanding on the relevance and techniques used in clinical medicine to interview new patients and giving a new patient presentation. Players begin the SPERPG by entering the in-world clinic examination room and selecting one of the new patients to interview. A selected new patient then appears as an artificial-intelligent (AI) avatar bot and takes a seat on the examination table. The player can review the patient's vital signs and existing information before starting the interview using the OLD CARTS mnemonics for helping to determine a medical problem. Patient interviews take place by typing questions in the chat window followed by patient responses using a Lisp parser for each patient trained on the basis of the underlying symptoms associated with a medical problem. Following the interview of a patient, the player then presents the differential diagnosis using an online new patient presentation template.

Slippery Rock Falls MPERPG. This multi-player simulation was designed to help 2-member teams learn how to improve collaboration and communication skills while solving an obstacle problem (see Figure 8).

Figure 8. Slippery Rock Falls MPERPG simulation.

In this MPERPG simulation the goal is to get one of the players (assuming the role of Traveler) safely across the Slippery Rock Falls rapids with assistance from the other team player (assuming the role of Guide). The player assuming the role of Guide receives a Heads-Up-Display (HUD) for one of the four rapids crossing paths.

Using the HUD, the Guide gives voice directions to the Traveler for safely crossing the rapids using the slippery rocks. The ultimate goal is for the Guide to help get the Traveler safely across the slippery rocks to the other side of the rapids in the best time possible. If the Traveler slips into the rapids, from taking a wrong step, then the journey starts over. An in-world stopwatch is provided for recording the duration time it takes to get across the rapids safely. After completing the simulation, the team completes a self-assessment rubric designed for the MPERPG using an online survey tool (see Figure 9).

Data on simulation start and finish time, path taken, restarts, and completion indicator is collected for player feedback. The self-assessment rubric is used for player and team feedback and optional use for discussions about the team's performance with the MPERPG simulation.

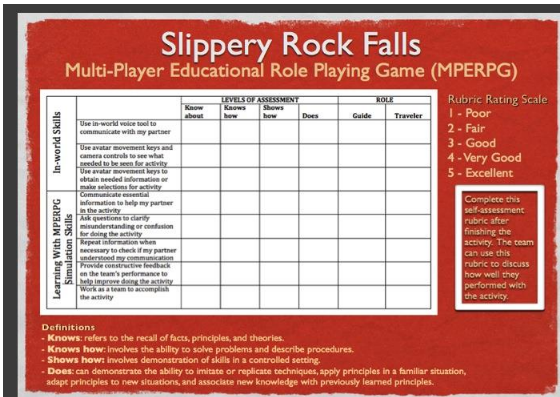

Figure 9. Slippery Rock Falls MPERPG simulation rubric.

Flight Crew Communications MPERPG. This MPERPG simulation is designed for two to four players assuming flight crew roles associated with events surrounding the crash of United Airlines Flight 232 on July 19, 1989 (see Figure 10).

Figure 10. Flight Crew Communications MPERPG simulation.

The goal of the MPERPG is to help players understand Crew Resource Management (CRM) and the importance of effective flight crew communications even when sterile cockpit rules are in effect. In the simulation players are taken through the sequence of events leading up to the crash of Flight 232 using in-world cockpit and flight path history simulators. Transcripts of crew communication are used in the MPERPG to help players understand the historical sequence of events. Players are offered the opportunity to predict outcomes of flight crew decisions as events unfold in the simulation through the accomplishment of simulation quests associated with helping to develop understanding of the initial mechanical malfunction, characteristics of flight crew communication, the crash site, and conclusions from the National Transportation Safety Board (NTSB) report on Flight 232.

Summary

Even though there are integration challenges to address for using SPERPG and MPERPG simulations, via an ILE supporting a MOOC, the importance of collaborative design thinking and design-build prototyping cannot be overstated for anticipating the challenges and creatively solving them for successful implementations. The authors found collaborative idea generation instrumental for collecting and synthesizing vast amounts of knowledge sharing and group work by the participants. The use and sequence of session topics also helped to introduce and address the essence of integration challenges and prepare participants to collaboratively engage in design-build prototyping work for the SPERPG and MPERPG simulations.

Feedback collected from the MOOC session discussions and participant use of the SPERPG and MPERPG simulations highlight the following lessons learned:

- Components, supported by the ILE architecture, provided reliable data connections across the LMS, 3D world campus, and mobile app; further work is needed to address simultaneous IP-voice connections across two or more components
- Support for movement of learning content in and out of LMS with the 3D world campus was clearly demonstrated across the MOOC sessions
- The collection of learning data from the SPERPG and MPERG simulations offer visibility on gaps of understanding with learning new concepts along with gaps in the application of knowledge and skills
- The employment of game-like design elements (in the form of role playing, points, and immediate feedback) by the SPERPG and MPERPG simulations improved the engagement and perceived value of learning with simulations in a MOOC
- The variety introduced by the ILE for organizing, presenting, and supporting self-paced and group effort supports

the flexible ways people can learn with simulations in a MOOC to improve engagement and interactivity

- Scaling for a MOOC remains a challenge for facilitated learning via synchronous sessions and activities; however, well designed self-paced learning simulations can help with engaging learners interactively with content
- The use of open-source educational technology components helped to better balance benefits with costs along with the application of a design to better integrate the components into an ILE
- Engaging educators with MOOC test beds helps build shared understanding of better ways to address real world limits by providing for exploratory insights on innovation prospects with disruptive technologies

Overall, the experience of the authors with the collaborative effort among the educators to design-build and prototype the SPERPG and MPERPG simulations for usage in a MOOC proved to be very enjoyable and beneficial for exploring the art-of-the-possible for learning with simulations to improve engagement and interactivity.

Disclaimer

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